REMARKS

Upon entry of the present amendment, claims 1 and 4 will be amended, whereby claims 1-9 will remain pending.

By the amendment herein, independent claims 1 and 4 have been amended to even more explicitly recite Applicants' claimed subject matter. In this regard, while the claims should be considered to include the subject matter as amended herein, the claims have been amended as discussed with the Examiner during a telephone interview as discussed below. Support for the amendment, appears in Applicants' claims as well as in Applicants' originally filed application, such as at page 1, paragraph [0002]; pages 1 and 2, paragraph [0004]; pages 2 and 3, paragraph [0007] and page 7, paragraph[0020].

Thus, as noted above, the claims have been amended to even more explicitly recite the subject matter recited therein, and no estoppel should be deemed to attach thereto.

Reconsideration of the rejections of record and allowance of the application in view of the following remarks are respectfully requested.

Statement of Interview

Applicants express appreciation for the courtesies extended by Examiner Mark Shevin to Applicants' representative Arnold Turk during a January 14, 2010 telephone interview.

During the interview, Applicants' claimed subject matter was discussed including reference to the specification particularly pointing out disclosure relating to vapor phase chemical reactions and super-micro particles. The Examiner indicated that amendment of the claims to even more explicitly recite performing a vapor phase chemical reaction may be beneficial. In fact, the Examiner indicated possible withdrawal of rejections with the exception of the rejection

of claims 1-3 and 7 based upon Otsuka in view of Richardson and US '193 if the claims were amended to more explicitly recite a vapor phase reaction process.

Amendment of the claims to recite a particle size of not more than 0.4 μm was also discussed. The Examiner indicated that anticipation rejections based upon documents that do not include particle size therein would appear to be overcome by claims including such recitation.

Regarding the rejection based upon Otsuka in view of Richardson and U.S. '193, the Examiner indicated that arguments should be presented against use of $CuCl_2$ in the Otsuka process as it would apparently render the process easier to perform.

Information Disclosure Statements

Applicants express appreciation for the Examiner's confirmation of consideration of Applicants' Information Disclosure Statement, filed June 30, 2009 by including an initialed copy of the Form PTO-1449 submitted therewith with the Office Action.

Response To Rejection Under 35 U.S.C. 112, Second Paragraph

Claims 1-8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite.

The rejection contends that, in claims 1 and 4, the terminology "super-micro" powder is vague and indefinite, because it is not clear what size powder resides in the term "super-micro". The rejection contends that any size particle in the prior art can be read on such terminology.

Regarding the terminology "super-micro", Applicants once again submit that one having ordinary skill in the art would readily understand the metes and bounds of the claims, so that the claims are definite. For example, the Examiner's attention is once again directed to page 1,

paragraph [0002] of Applicants' specification wherein super-micro particles having a particle size of not more than 0.4 μm are disclosed. Certainly, one having ordinary skill in the art would understand the meaning of super-micro powder following such description in Applicants' specification.

In any event, by the present amendment claims 1 and 4 have been amended to include that the super-micro particles have a particle size of not more than 0.4 μm.

Accordingly, the 35 U.S.C. 112, second paragraph, indefiniteness rejections should be withdrawn.

Response To Art Based Rejections

The following rejections are set forth in the Final Office Action.

(a) Claims 1, 2 and 9 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 2,642,356 (hereinafter "US '356") or U.S. Patent No. 2,642,357 (hereinafter "US '357").

(b) Claims 3 and 7 are rejected under 35 U.S.C. 102(b) as being anticipated by US '356.

(c) Claims 4-6 and 8 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 2,754,193 (hereinafter "US '193") or U.S. Patent No. 2,754,195 (hereinafter "US '195").

(d) Claim 1-3 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 4,810,285 to Otsuka (hereinafter "Otsuka") in view of Richardson (H.W. Richardson, "Copper Compounds", in Ullmann's Encyclopedia of industrial Chemistry, Wily-VCH Verlag, June 15, 2000, pp. 1-13 and US '193.

(a) Claims 1, 2 and 9 are not properly rejected as being anticipated by US '356 and US '357

Applicants submit that neither of US' 356 nor US '357 teaches each and every feature recited in claims 1, 2 and 9 so that the rejections should be withdrawn.

Applicants' independent claim 1 is directed to a method of producing super-micro powder of a pure metal having a particle size of not more than 0.4 μm comprising performing a vapor phase chemical reaction including heating a starting material forming metal chloride vapor, the starting material containing metal chloride and elemental metal of the metal contained in the metal chloride, and reducing the metal chloride vapor with hydrogen gas to produce the super-micro powder of a pure metal having a particle size of not more than 0.4 μm. Therefore, amongst the features recited in independent claim 1, and further patentably defined in claims 2 and 9, the metal chloride and an elemental metal of the metal chloride are used as a starting material, and the starting material is heated to make the metal chloride and the elemental metal react for generating the metal chloride vapor which is reduced by hydrogen gas and reducing the metal chloride vapor with hydrogen gas to produce the super-micro powder of a pure metal having a particle size of not more than 0.4 μm.

During the above-noted telephone interview, it appeared that the Examiner indicated that these anticipation rejections should be withdrawn because neither of US '356 nor US '357 discloses each and every feature recited in Applicants' claims including Applicants' recited process producing the super-micro powder of a pure metal having a particle size of not more than 0.4 μm.

As previously argued by Applicants, US '356 discloses a technique relating to a low temperature reducing method of a Ni- chloride, pure metal Ni added in a raw material is added as

a reaction initiating catalyst for initiating the above reducing reaction at a low temperature in case of reducing $NiCl_2$ to obtain fine powder of Ni, and is not added as raw material for producing fine powder by forming lower metal chloride vapor as in the present invention.

Thus, the present method is directed to a vapor phase chemical reaction method for reducing vapor generated by heating a starting material containing metal chloride and elemental metal of the metal chloride. In such a method the formed metal chloride can have a lower valence than the starting material metal chloride, as see, for example, paragraph [0023] on page 9 of Applicants' specification. In contrast, US '356 is directed to a low temperature method of directly reducing $NiCl_2$, and not the reduction in the vapor phase in a vapor phase chemical reaction. It is seen that US '356 does not disclose a vapor phase chemical reaction method, because the fine powder obtained by reduction should be formed at a place different from a position where the raw material is placed. See, for example, the top of page 6 of Applicants' specification wherein the heated metal chloride is evaporated with the rise of temperature and transported to the reduction part 3. However, in the producing method of US '356, as apparent from Example 1, the formed reduction Ni is existent as it is on the raw material charged boat. This means that the $NiCl_2$ in US '356 is reduced without changing into vapor.

Thus, US '356 does not disclose a method of producing super-micro powder of a pure metal having a particle size of not more than 0.4 μm comprising performing a vapor phase chemical reaction including heating a starting material forming metal chloride vapor, the starting material containing metal chloride and elemental metal of the metal contained in the metal chloride, and reducing the metal chloride vapor with hydrogen gas to produce the super-micro powder of a pure metal having a particle size of not more than 0.4 μm.

For similar reasons, US '357 also does not teach each and every feature recited in Applicants' claims.

Accordingly, for at least the reasons set forth above, the anticipation rejections are without appropriate basis and should be withdrawn,

(b) Claims 3 and 7 are not properly rejected under 35 U.S.C. 102(b) as being anticipated by US '356.

Claims 3 and 7 depend upon claims 1 and 2, respectively, and further patentably recite that the metal chloride is at least one of $CuCl_2$, $FeCl_3$ and $NiCl_2$. The rejection contends that US '356 discloses $NiCl_2$ as the metal chloride.

In response, Applicants submit that the rejection of claims 3 and 7 is without appropriate basis at least for the reasons set forth with respect to the rejection of claims 1 and 2 as being anticipated by US '356. Accordingly, the rejection should be withdrawn for at least this reason. Moreover, while US '356 discloses $NiCl_2$, US '356 does not disclose the use of $NiCl_2$ in a process as recited in Applicants' claims, and therefore the rejection is without appropriate basis for this additional reason.

Accordingly, the anticipation rejection should be withdrawn.

(c) Claims 4-6 and 8 are not properly rejected as being anticipated by US '193 or US '195".

Applicants submit that neither of US '193 nor US '195 teaches each and every feature recited in claims 4-6 and 8 so that the rejections should be withdrawn.

Applicants' independent claim 4 is directed to a method of producing super-micro powder of an alloy having a particle size of not more than 0.4 μm comprising performing a vapor

phase chemical reaction including heating a starting material forming metal chloride vapor, the starting material containing metal chloride and elemental metal as alloying components; and reducing the metal chloride vapor with hydrogen gas to form the super-micro powder of an alloy having a particle size of not more than 0.4 μm. Therefore, amongst the features recited in independent claim 4, and further patentably defined in dependent claims 5-6 and 8, metal chloride and elemental metal are used as a starting material, and the starting material is heated to make the metal chloride and the elemental metal react for generating the metal chloride vapor which is reduced by hydrogen gas to form the super-micro powder of an alloy having a particle size of not more than 0.4 μm.

During the above-noted telephone interview, it appeared that the Examiner indicated that these anticipation rejections should be withdrawn because neither of US '193 nor US '195 discloses each and every feature recited in Applicants' claims including Applicants' recited process producing the super-micro powder of an alloy having a particle size of not more than 0.4 μm.

As previously argued by Applicants, US '193 discloses the reduction of $CuCl_2$ only with the use of raw material prepared by mixing Fe powder in $CuCl_2$ and obtaining a mixed material of Cu powder and Fe powder, which is clearly different from the subject matter recited in independent claim 4 and the claims dependent therefrom. Claim 4 relates to producing super-micro powder alloy wherein a vapor phase chemical reaction method is used for obtaining super-micro powder of alloy by heating a metal chloride and reducing the generated metal chloride vapor with hydrogen gas. Therefore, as discussed above, a raw material charging place would differ from the place for obtaining a reduced product in such a vapor phase chemical reaction.

In contrast, the method of producing Cu-Fe powder of US '193 is, as described in Example 1, that raw material powder of $CuCl_2$ and Fe mixed at a predetermined rate is spread on a tray, placed in a muffle furnace, heated, and reduced by hydrogen gas being flowed on the tray. The product is obtained under the semi-sintered state on the tray where a raw material is charged. This indicates that in the producing method of US '193, a raw material of $CuCl_2$ and mixed Fe powder do not become vapor, that is, $CuCl_2$ is only directly reduced on the tray.

Further, regarding the product obtained by the producing method of US '193, the alloy does not become vapor of a metal chloride to be mixed and reduced and therefore cannot be considered as vapor of (Cu-Fe) alloy, but is simply a mixture of Cu powder formed by reducing and Fe powder added in raw material.

For similar reasons, US '195 also does not teach each and every feature recited in Applicants' claims.

Accordingly, for at least the reasons set forth above, the anticipation rejections are appropriate basis and should be withdrawn.

(d) Claims 1-3 and 7 are not properly rejected as being obvious in view of Otsuka, Richardson and US '193.

Applicants submit that one having ordinary skill in the art would not have combined the disclosures of Otsuka, Richardson and US '193, and that any combination thereof (assuming for the sake of argument that they can be combined) would not have arrived at Applicants' recited subject matter.

As noted above, Applicants' independent claim 1 is directed to a method of producing super-micro powder of a pure metal having a particle size of not more than 0.4 μm comprising performing a vapor phase chemical reaction including heating a starting material forming metal

chloride vapor, the starting material containing metal chloride and elemental metal of the metal contained in the metal chloride, and reducing the metal chloride vapor with hydrogen gas to produce the super-micro powder of a pure metal having a particle size of not more than 0.4 μm. Therefore, amongst the features recited in independent claim 1, and further patentably defined in dependent claims 2, 3 and 7, the metal chloride and an elemental metal of the metal chloride are used as a starting material, and the starting material is heated to make the metal chloride and the elcmental metal react for generating the metal chloride vapor which is reduced by hydrogen gas to produce the super-micro powder of a pure metal having a particle size of not more than 0.4 μm.

A process for obtaining Cu super-micro powder with the use of $CuCl_2$ as a raw material is simply shown as follows.

Heating ($CuCl_2$ + Cu)→ vapor of CuCl + H_2 → Cu powder.

As compared with this, Otsuka discloses a method of obtaining Cu fine powder by reducing CuCl with H_2 by a vapor phase chemical reduction method. However, the Otsuka method merely discloses the right half reaction of the above process. Otsuka does not discloses heating a starting material forming metal chloride vapor, the starting material containing metal chloride and elemental metal of the metal contained in the metal chloride.

Further, the Otsuka method is a vapor phase chemical reaction of a conventional technique described in the paragraph [0005] of the present specification, and has a problem of high raw material cost because of using material having a small valence, and therefore does not teach or suggest the subject matter recited in Applicants' claims 2, 3 and 7.

Regarding US '193, as discussed above, the method of producing Cu-Fe powder of US '193 is, as described in Example 1, that raw material powder of $CuCl_2$ and Fe mixed at a

predetermined rate is spread on a tray, placed in a muffle furnace, heated, and reduced by hydrogen gas being flowed on the tray. The product is obtained under the semi-sintered state on the tray where a raw material is charged. This indicates that in the producing method of US '193, a raw material of $CuCl_2$ and mixed Fe powder do not become vapor, that is, $CuCl_2$ is only directly reduced on the tray. Because the obtained Cu-Fe powder of US '193 is generated in the tray where the starting material is placed, US '193 does not relate to a vapor phase chemical reaction process, and one having ordinary skill in the art would not have combined the disclosures of Otsuka and US '193 as asserted in the Final Office Action.

Thus, regarding the product obtained by the producing method of US '193, the alloy does not become vapor of a metal chloride to be mixed and reduced and therefore cannot be considered as vapor of (Cu-Fe) alloy, but is simply a mixture of Cu powder formed by reducing and Fe powder added in raw material.

Still further, the super-micro metal powder obtained by reducing the metal chloride vapor in the metal reduction method of the present invention is a powder with the particle size of not more than 0.4 μm. In contrast, the Cu-Fe powder in US '193 is obtained in the state of "a semi-sintered" cake as described in Example I and the obtained powder by fracturing the cake is 100 mesh (1.50 μm), which is enormously larger than the super-micro powder obtained in the present invention. This appears to be further evidence that Cu-Fe obtained in US'193 is not the result of the reduction of the metal chloride vapor.

Therefore, the disclosures of Otsuka and US '193 are not combinable in view of their diverse disclosures. However, even if for the sake of argument the disclosures were combined, the claimed subject matter would not be present for at least the reason that neither Otsuka nor US '193 teaches or suggests that the metal chloride and an elemental metal of the metal chloride are

used as a starting material, and the starting material is heated to make the metal chloride and the elemental metal react for generating the metal chloride vapor which is reduced by hydrogen gas to produce the super-micro powder of a pure metal having a particle size of not more than 0.4 µm. Applicants' process permits the obtaining of inexpensive powder of super-micro powder of a pure metal.

Regarding Richardson, Applicants submit that Richardson discloses a method of producing CuCl by reacting $CuCl_2$ and Cu. However, Richardson discloses, the technique relating to a producing method for obtaining CuCl <u>under the fused state by reacting Cu and $CuCl_2$ with the use of a shaft furnace, but does not disclose a technique of obtaining CuCl with the use of vapor phase chemical reacting</u>. Therefore, Richardson merely describes a chemical reaction formula for producing CuCl and has no relation to a vapor phase chemical reaction.

The Final Office Action contends:

> In response, the instant claims do not require reducing $CuCl_2$ to CuCl in the vapor phase, only that a starting material of a metal chloride and elemental metal of the metal contained in the metal chloride are heated together to form a metal chloride. Richardson teaches that CuCl2 is reduced to CuCl by contact with CuCl [sic Cu], and the phase of the reaction product is moot in that the CuCl produced would be in vapor phase according to Otsuka's disclosure.

In contrast, in Richardson's technique, $CuCl_2$ and Cu react with each other in the melting state, and there is no teaching or suggestion to include such reaction in a vapor phase chemical reaction as disclosed in Otsuka. The rejection appears to contend that the process of Otsuka would apparently be easier to perform. However, it is not seen why one having ordinary skill in the art would include additional steps in Otsuka based upon a different type of reaction process. The rejection needs to address all of these issues.

Expanding upon the above, Applicants note that the Examiner appears to be basing the assertion that use of $CuCl_2$ in the Otsuka process would apparently render the process easier to perform based up the Examiner's supposed lack of a technical problem in using $CuCl_2$ instead of CuCl in the Otsuka process. However, at the time of Otsuka's invention, the use of $CuCl_2$ alone as a starting material would not have been adopted for the production of a super micro powder for a number of reasons.

First, $CuCl_2$ has an extremely low vapor pressure compared to CuCl. Therefore, there is no reporting about vapor pressure of $CuCl_2$.

Moreover, the thermal decomposition of $CuCl_2$ occurs when it is heated and Cl_2 gas is generated by the following formula:

$2\ CuCl_2 \rightarrow 2CuCl + Cl_2$

This Cl_2 gas would react with H_2 gas introduced for obtaining the super micro powder of Cu by reproducing CuCl, with HCl being formed. Because of this, the reaction efficiency (yield ratio) of H_2 gas is lowered or the obtained super micro powder of Cu would be contaminated. Furthermore, Cl_2 and H_2 gas would be expected to react very strongly with each other, which may cause an explosion.

Therefore, for using $CuCl_2$ as the material, the system would need to be constructed for removing generated Cl_2. This would make the reaction complicated so that controlling of the reaction can be difficult and/or can require more facilities or auxiliary material leading to higher production costs.

For at least the above, the idea of using $CuCl_2$ of high valence as the material would not have occurred to one having ordinary skill in the art based upon Otsuka.

In contrast, the inventors of the present application found that when a less expensive material, such as $CuCl_2$, is mixed with elemental metal, such as Cu, $CuCl_2$ is decomposed to generate Cl_2 which reacts with Cu so that a large amount of CuCl vapor can be generated and thus were able to achieve the presently claimed subject matter. One having ordinary skill in the art would not have arrived at Applicants' claimed subject matter based upon Otsuka which does not have the idea of using inexpensive metal chloride, such as $CuCl_2$ of high valence, as the starting material.

For at least the reasons set forth above, there is no reason to combine Richardson with Otsuka and/or US '193. However, even if for the sake of argument the disclosures were combined, the claimed subject matter would not be present for at least the reason that any combination of Otsuka, US '193 and Richardson would not arrive at the metal chloride and an elemental metal of the metal chloride being used as a starting material, and the starting material being heated to make the metal chloride and the elemental metal react for generating the metal chloride vapor which is reduced by hydrogen gas to produce the super-micro powder of a pure metal having a particle size of not more than 0.4 μm.

Accordingly, for at least the reasons set forth above, the rejections of record should be withdrawn.

CONCLUSION

In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections of record, and allow each of the pending claims.

Applicants therefore respectfully request that an early indication of allowance of the application be indicated by the mailing of the Notices of Allowance and Allowability.

Should the Examiner have any questions regarding this application, the Examiner is invited to contact the undersigned at the below-listed telephone number.

Respectfully submitted,
Yasunori YONEHANA et al.

Bruce H. Bernstein
Reg. No. 29,027

Arnold Turk
Reg. No. 33094

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GREENBLUM & BERNSTEIN, P.L.C.
1950 Roland Clarke Place
Reston, VA 20191
(703) 716-1191

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